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126. (New) The imaging device according to claim 116, further comprising a gate stack over said substrate and beneath said insulating layer, wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

127. (New) The imaging device according to claim 117, further comprising a gate stack over said substrate and beneath said insulating layer, wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

128. (New) The imaging device according to claim 118, further comprising a gate stack over said substrate and beneath said insulating layer, wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

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129. (New) The imaging device according to claim 119, further comprising a gate stack over said substrate and beneath said insulating layer, wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

### REMARKS

Reconsideration and allowance of the application are respectfully requested in light of the foregoing amendments and the following remarks.

*[Handwritten signature]*

In response to the Patent and Trademark Office's request, applicant has included revised Figures 1, 2 and 3 with the legend "PRIOR ART" indicated in red. The Office's approval of these revisions is respectfully requested.

Claims 1-29, 31-39, 41-63, 65-70 and 115-124 are pending in the application. Claims 67-70 have been canceled in response to the restriction requirement without prejudice to their being pursued in a separate application.

Claim 39 has been amended in response to the rejection under 35 U.S.C. §112, second paragraph, discussed *infra*. In particular, the relationship between the “active pixel sensor”, “photogate” and “charge collection area” has now been specified.

Claim 66 has been amended in response to the rejection under 35 U.S.C. §112, first paragraph, also discussed *infra*. The claimed invention has now been properly designated as a “component” of a camera system.

Amended claims 120-124 and new claims 125-129 are directed to additional embodiments of the invention. Support therefor is taken from the specification, *inter alia*, with reference to Figure 7.

Claims 5, 6, 16, 17 and 24 have also been canceled so as to preserve the total number of claims pending in the application in light of newly added claims 125-129. Their cancellation is without prejudice to their being pursued in a separate application. Applicant is not surrendering the subject matter contained therein.

Entry of the foregoing amendments and new claims is respectfully requested as it is believed they place the case in better condition for allowance and/or in better form for consideration on appeal as set forth below.

Claim 66 was rejected under 35 U.S.C. §112, first paragraph. The Office stated that the “processor” of claim 53 for particular use in a “camera” system is unclear from the specification. In response, it is believed that claim 66 now properly recites that the claimed invention is a component of a camera-based system. Based on the foregoing, withdrawal of the §112 rejection is respectfully requested.

Claims 39, 41-52, 118 and 123 stand rejected under 35 U.S.C. §112, second paragraph. Based on the foregoing amendment to claim 39, withdrawal of the rejection is respectfully urged.

Claims 1-3, 5-7, 12, 15-19, 24-26, 28, 29, 31-33, 38, 39, 41-44, 46, 51, 53-55, 57-59, 65, 66 and 115-119 stand rejected under 35 U.S.C. §103 as being obvious over Figures 1-2 and pages 1-12 of the application, together with Nagasaki et al., U.S. Patent No. 5,307,169. This rejection is respectfully traversed for the following reasons.

It is respectfully submitted that Nagasaki et al. would not have led the skilled artisan to a nitrogen containing insulative layer. Instead, the reference specifically excludes silicon nitride by specifying that the insulative layer "4" contain "high" dielectric material. In this regard, the PTO's attention is again directed to column 3, lines 25-30 and TABLE 1 of the cited reference. There the patentees state that "high" dielectric material includes material with a dielectric constant "of 20 or more." A laundry listing of several compounds is then provided, none of which contain any nitrogen. Silicon nitride ( $\text{Si}_3\text{N}_4$ ), in contrast, is instead noted as having a "low" dielectric constant of only 10. Thus, Nagasaki et al. unequivocally teaches away from the claimed invention.

In response to the Office's remarks on page 4 of the final Office Action, it should be noted that the present applicant was not simply seeking a higher dielectric material than silicon dioxide, but one which worked in his particular structure. Nagasaki et al. would have been of scant help in this regard. Nagasaki et al. unquestionably teaches to avoid a nitrogen-containing compound such as silicon nitride. When faced with these prospects, the skilled artisan would have likely turned away from this reference. Any reference which equates *both* silicon dioxide *and* silicon nitride as having "low" dielectric potential would have not moved the skilled artisan to utilize its teachings. He or she would not have formed a nitrogen containing layer as a dielectric over a substrate in the context of the claimed invention after reviewing this disclosure.

As further regards claims 115-119, Nagasaki et al. would have not led the skilled artisan to a structure in which the nitrogen containing layer had been removed wherever it was not covered by a photogate. The Office's attention is directed to Figures 1

through 6 of Nagasaki in this regard. Review of these drawings clearly indicates that the cited reference teaches away from the embodiments of claims 115-119. In fact, Nagasaki et al. specifically chooses not to remove the insulating layer (see component 8' in Figure 4 for one example).

For at least the foregoing reasons, Nagasaki et al. can not form the basis for an obviousness rejection together with applicant's alleged disclosure. Withdrawal of the §103 rejection is therefore respectfully urged.

Claims 4, 27, 45, 56 and 120-124 stand rejected under 35 U.S.C. §103 as being obvious over alleged parts of the pending application together with Nagasaki et al. as applied above, further considered with Koike et al., U.S. Patent No. 4,143,389. This rejection is also respectfully traversed.

As previously set forth, Koike et al. does not remedy the significant deficiencies associated with the cited Nagasaki et al. reference. In particular, Koike et al. refers to an "insulating oxide film" for use as part of a solid-state image pickup device. Once again, no hint, teaching or suggestion is made within the reference to utilize any nitrogen-containing material in the insulating layer. It is therefore respectfully submitted that the skilled artisan would not have been moved closer to the claimed invention after exposure to the teachings of Koike et al.

The Office should further note that the "oxide insulating layer" described in Koike et al. could have referred to *any* oxide material. No differentiation is made between dielectric materials of silicon dioxide and those containing nitrogen, for example. Moreover, Koike et al. clearly does not resolve Nagasaki et al.'s position of equating both silicon dioxide and a nitrogen containing compound as "low" dielectric materials, and therefore unsuitable as insulators. Thus, the skilled artisan would not have advanced his knowledge obtained after reading Nagasaki et al. by further reviewing Koike et al. He or

she would not have been motivated to utilize a nitrogen containing material as set forth by the present applicant.

As regards claims 120-124, it is respectfully submitted that the present applicant is not claiming a buried electrode. Instead, a combination of features has been recited which is not taught or suggested by any of the cited references, either Nagasaki et al. or Koike et al., either alone or in combination with one another and with the alleged disclosure in applicant's specification. Since Koike et al. does not remedy Nagasaki et al.'s problem concerning the use of silicon nitride or other nitrogen containing material, then it can not be construed as *also* teaching any of the structural embodiments set forth in claims 120-124.

Based on the foregoing, it is respectfully submitted that even the combination of the aforecited Nagasaki and Koike et al. references, together with applicant's alleged disclosure, fails to render obvious what has been claimed herein. Withdrawal of the §103 rejection is accordingly respectfully urged.

Claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 stand rejected under 35 U.S.C. §103 as being unpatentable over alleged parts of the pending application together with Nagasaki et al., when further combined with Suzuki, U.S. Patent No. 4,385,307. This rejection is also respectfully traversed.

Suzuki, like Koike et al., does nothing to advance the state of the art embodied in the Nagasaki et al. reference. Suzuki teaches to "bury" electrodes within an insulating film that is comprised of pure silicon oxide *or* a composite of silicon nitride with silicon oxide. Suzuki thus treats these materials as merely interchangeable. The skilled artisan would have simply substituted one material for the other, based on these teachings. There is no suggestion whatsoever that silicon oxide material by itself does not form an insulating film with acceptable electrical characteristics. Therefore the combination of the previously cited disclosures together with Suzuki would still have been woefully inadequate

in directing the person skilled in the art to what the present applicant has recited. For at least these reasons, it is respectfully submitted that this combination of the cited references is improper, and therefore the rejection should be withdrawn.

Finally, Claims 8, 9, 13, 20, 21, 34, 35, 47, 48, 52, 60 and 61 stand rejected under 35 U.S.C. §103 as being obvious over alleged parts of the present application together with Nagasaki et al., when further combined with Okada et al., U.S. Patent No. 5,241,198. This rejection is also respectfully traversed.

It is respectfully submitted that the combination of Nagasaki et al. with Okada et al. is not well founded. The Office has cited the latter reference for its alleged teachings regarding an "ONO" layer, i.e. an oxide-nitride-oxide layer. In contrast, Nagasaki et al. is quite explicit in excluding both silicon oxide and nitrogen-based films from its laundry listing of possible insulative materials. The patentees make it clear that a compound such as  $\text{Si}_3\text{N}_4$  is a "low" dielectric material and is therefore not suitable as a "high" dielectric insulating film. Thus, it is respectfully submitted that combining the disclosure of Okada et al. with that of Nagasaki et al. would have only destroyed the very foundation of the Nagasaki et al. reference. Nagasaki et al. simply does not want a nitrogen containing compounds in an insulating film. Forcing an "ONO" layer (or any nitrogen containing material) onto the semiconductor substrate of Nagasaki et al. would therefore have debased the patent's entire disclosure. Further in this regard, the PTO will note that even the secondary insulative layer "22" of Nagasaki et al. is described as merely being  $\text{SiO}_2$  material. Once again, there is no mention of nitrogen-containing compounds for use as insulative materials.

In response to the Office's remarks bridging pages 3 and 4, the issue is not whether the applicant would agree that a nitrogen containing material would have had a higher dielectric constant than silicon dioxide. The issue is whether the skilled artisan would have been motivated to utilize such a material when faced with the clearly negative perception of silicon nitride presented by Nagasaki et al. Nagasaki's mandate would have

been clear, i.e. avoid this material as a suitable dielectric. And Okada's teachings of an ONO layer would not have resolved the issue. At best, the skilled artisan would have been presented with contradictory and incompatible teachings which neither reference could resolve.

It is therefore respectfully submitted that the two disclosures can not sustain a *prima facie* case of obviousness. For at least these reasons, it is respectfully urged that the §103 rejection based on the combination of Nagasaki et al. and Okada et al. references is improper and should be withdrawn.

In addition, it is further submitted that none of the cited references, either alone or in combination with one another, teach or suggest the features which are set forth in applicant's newly amended claims 120-124 or new claims 125-129. None show any appreciation for a semiconductor device in which a nitrogen-containing insulative layer has been etched back wherever it is not covered, and therefore protected by the overlaid conductive layer or photogate. Moreover, there is no appreciation of a gate stack upon which an insulative layer and then a conductive layer are built. There is no teaching of a device in which a nitrogen containing insulative layer is over a substrate and a gate stack, and beneath a photogate. In particular, there is no suggestion to position the gate stack over a silicon dioxide insulative layer, and the nitrogen containing layer over the gate stack.

In conclusion, it is respectfully submitted that each of the applicant's claims recites several features which have not been suggested by the art.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the remaining rejections, and pass the case to issue. Should he feel that any other point requires consideration, then he is cordially invited to contact the undersigned.

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Respectfully submitted,

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24/8/00  
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FIG. 2

PRIOR ART

OK to enter  
2/11/99  
23 August 2000

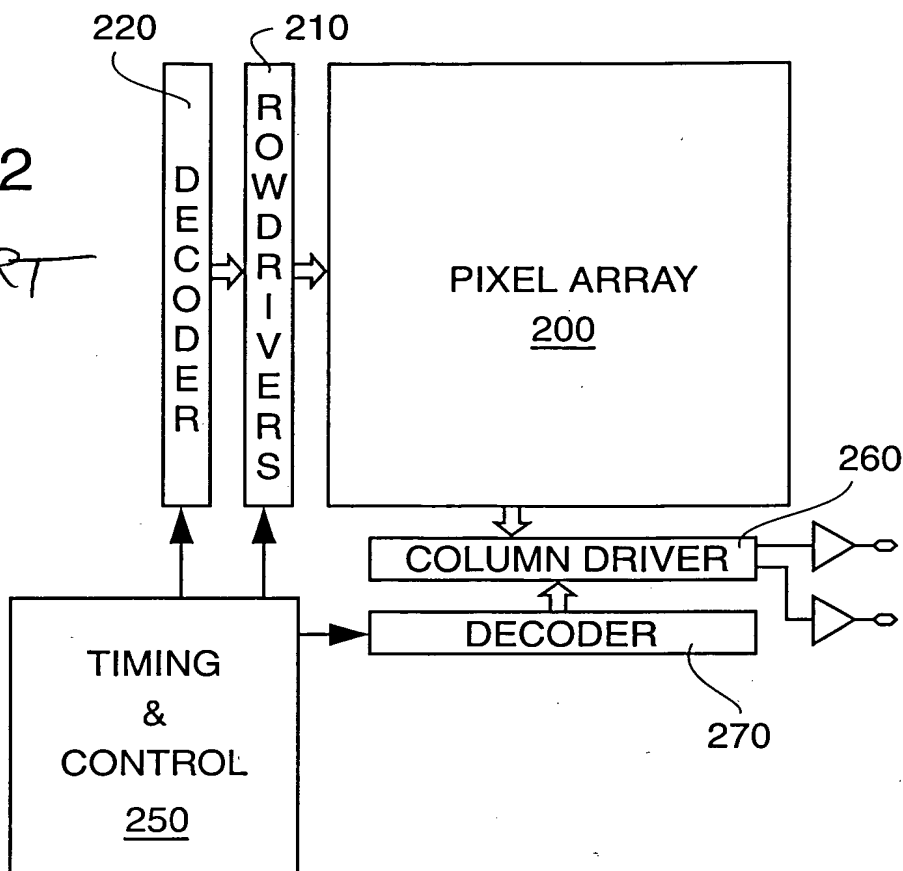


FIG. 3

PRIOR ART

